

UNITED STATE PATENT APPLICATION

OF

Ki Chul CHA

FOR

**DEVICE AND METHOD FOR CONTROLLING
DRYING OF LAUNDRY IN DRUM TYPE WASHING MACHINE**

[0001] This application claims the benefit of the Korean Application No. P2002-0073878 filed on November 26, 2002, which is hereby incorporated by reference.

BACKGROUND OF THE INVENTION

Field of the Invention

[0002] The present invention relates to drum type washing machines, and more particularly, to device and method for controlling drying of laundry in a drum type washing machine.

Background of the Related Art

[0003] Referring to FIGS. 1 and 2, a related art washing and drying machine is provided with a door 2 on a front part of a body 1, a tub 3 in the body 1, a drum 6 in the tub 3 for rotating upon receiving a driving force from a motor through a belt 5, a gasket 7 between a front part of the tub 3 and the body 1 for damping and packing when the drum 6 rotates, a detergent box 9 in an upper part of an inside of the body 1 connected to the tub 3 through a water supply hose 8, a discharge pump 10 and a discharge hose 11 in a lower part of an outside of the tub 3, and a washing heater 12 in a lower of an inside of the tub 3.

[0004] The related art washing and drying machine is also provided with a fan 13 in the upper part of the body 1, wherein the fan 13 and the gasket 7 are connected with an air duct 14 such that the fan blows air to insides of the tub 3 and the drum 6, a drying heater 15 in the air duct for heating the air blown through the air duct, a condensing duct 16 connected between the fan 13 and the tub 3 for serving as an air passage, and a condensed water pipe 17 and a water inlet 18 at one side of the body 1 for supplying condensed water into the condensing duct 16 to cool down circulating air with cold water.

[0005] Therefore, when a user opens the door 2, introduces laundry into the drum 6, and selects an operation button, washing water is introduced into the tub 3 through the

detergent box 9 guided by the water supply hose 8, until the water fills the tub 3 and the drum 6 in the tub 3 to a required level 6.

[0006] When the washing water is filled in the tub 3 and the drum 6 to the required level 6, the water supply is stopped, the motor 4 rotates in regular/reverse directions, and a driving power of the motor 4 is transmitted to the drum 6 through a belt 5, to rotate the drum 6 in the regular/reverse directions at regular intervals, when the laundry is made fluid by lifts (not shown) on an inside circumferential surface of the drum 6, to progress washing by a friction force between the laundry and the drum, and a dissolving capability of the detergent.

[0007] If the user selects a water temperature before starting the washing, the washing water in the drum 6 is heated to the selected temperature as the washing heater 12 generates heat.

[0008] Upon finishing a washing cycle, the discharge valve 10 is opened, to discharge used washing water to an outside of the washing machine through the discharge hose 11, and upon finishing the discharge of water, a rinsing cycle is started in the same operation as the washing cycle.

[0009] After a rinsing process is repeated for a preset times, a spinning cycle is started. Upon finishing the spinning cycle, the drum 6 is rotated in regular/reverse directions to make the laundry fluid the same as the washing cycle, and the fan 13 is put into operation to blow air into the tub 3 and the drum 6. At this time, the drying heater 15 in the air duct 14 also generates heat, to heat the air blown into the tub 3 and the drum 6. According to this, moisture in the laundry is removed by hot air introduced into the drum 6. The hot air introduced into the drum 6 circulates back to the fan 13 through the condensing duct 16 connected between the fan and the tub 3.

[0010] However, in the related art washing and drying machine, since the user carries

out the drying cycle for a preset time period in the drying cycle, the drying cycle is progressed regardless of a quantity of the laundry, or a moisture content of the laundry, to cause problems in that the laundry is dried insufficiently, or power is consumed, excessively.

SUMMARY OF THE INVENTION

[0011] Accordingly, the present invention is directed to device and method for controlling drying of laundry in a drum type washing machine that substantially obviates one or more of the problems due to limitations and disadvantages of the related art.

[0012] An object of the present invention is to provide device and method for controlling drying of laundry in a drum type washing machine, in which laundry can be dried, effectively.

[0013] Additional features and advantages of the invention will be set forth in the description which follows, and in part will be apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objectives and other advantages of the invention will be realized and attained by the structure particularly pointed out in the written description and claims hereof as well as the appended drawings.

[0014] To achieve these objects and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, the device for controlling drying of laundry in a drum type washing machine includes a motor for rotating a drum, a motor sensing part for detecting rotation speed of the motor, and a controlling part for controlling the motor sensing part to detect the rotation speed of the motor during a spinning time period, and setting a drying cycle time period according to the detected rotation speed.

[0015] The controlling part compares the detected rotation speed to preset rotation speeds. In this instance, the controlling part compares the detected maximum value of the

rotation speed to the set rotation speeds in an order of a maximum value thereof to a minimum value thereof, and the controlling part detects the set rotation speed the same with a maximum value of the detected rotation speed from the set rotation speeds, and determines the drying time period relevant to the detected set rotation speed as the drying cycle time period.

[0016] The controlling part sets the drying cycle time period the longer as the detected rotation speed is the lower, and vice versa.

[0017] In other aspect of the present invention, there is provided a device for controlling drying of laundry in a drum type washing machine including a motor for rotating a drum, a motor sensing part for detecting rotation speed of the motor, a fan for blowing air into the drum, a drying heater for heating the air from the fan, and a controlling part for controlling the motor sensing part to detect the rotation speed of the motor during a spinning time period, and setting a drying cycle time period according to an amount of laundry and the detected rotation speed.

[0018] The controlling part compares the detected maximum value of the rotation speed to the set rotation speeds in an order of a maximum value thereof to a minimum value thereof. The controlling part determines the drying time period relevant to the set rotation speed as the drying cycle time period if the maximum value of the detected rotation speed is equal to or higher than the set rotation speed.

[0019] The controlling part sets the drying cycle time period the longer, as the amount of the laundry is the greater.

[0020] In another aspect of the present invention, there is provided a method for controlling drying of laundry in a drum type washing machine, including the steps of (a) detecting a rotation speed of a motor during a spinning cycle, (b) setting a drying cycle time

period according to the detected rotation speed, and (c) drying the laundry for the set drying cycle time period.

[0021] The step of setting a drying cycle time period according to the detected rotation speed includes the step of comparing the detected rotation speed to set rotation speeds. The step of setting a drying cycle time period according to the detected rotation speed further includes the steps of detecting one of the set rotation speeds identical to a maximum speed of the detected rotation speed, and determining a drying time period relevant to the detected set rotation speed as the drying cycle time period.

[0022] The step of setting a drying cycle time period according to the detected rotation speed further includes the steps of comparing the maximum value of the detected rotation speed to the set rotation speeds in an order of a maximum value to a minimum value. The step of setting a drying cycle time period according to the detected rotation speed further includes the steps of determining the drying time period relevant to the set rotation speed as the drying cycle time period if the maximum value of the detected rotation speed is equal to or higher than the set rotation speed.

[0023] The step of setting a drying cycle time period according to the detected rotation speed further includes the steps of setting the drying cycle time period the longer as the detected rotation speed is the lower, and vice versa.

[0024] In further aspect of the present invention, there is provided a method for controlling drying of laundry in a drum type washing machine, including the steps of (a) detecting an amount of the laundry, (b) detecting a rotation speed of a motor during a spinning cycle, (c) setting a drying cycle time period according to the detected amount of the laundry and the detected rotation speed, and (d) drying the laundry for the set drying cycle time period.

[0025] The step of setting a drying cycle time period according to the detected

amount of the laundry and the detected rotation speed includes the steps of setting a drying time period according to the amount of laundry, and adjusting the set drying time period according to the rotation speed. The step of setting a drying time period according to the amount of laundry includes the step of setting the drying cycle time period the longer as the amount of laundry is the grater, and vice versa. The step of adjusting the set drying time period according to the rotation speed includes the step of setting the drying cycle time period the longer as the as the maximum value of the detected rotation speed is the smaller, and vice versa.

[0026] It is to be understood that both the foregoing description and the following detailed description of the present invention are exemplary and explanatory and are intended to provide further explanation of the invention claimed.

BRIEF DESCRITPION OF THE DRAWINGS

[0027] The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this application, illustrate embodiment(s) of the invention and together with the description serve to explain the principle of the invention. In the drawings;

FIG. 1 illustrates a longitudinal section of key parts of a related art drum type washing machine;

FIG. 2 illustrates a section of key parts across a line A-A in FIG. 1;

FIG. 3 illustrates a device for controlling drying of laundry in a drum type washing machine in accordance with a preferred embodiment of the present invention; and

FIG. 4 illustrates a flow chart showing the steps of a method for controlling drying of laundry in accordance with a preferred embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

[0028] Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings. FIG. 3 illustrates a device for controlling drying of laundry in a drum type washing machine in accordance with a preferred embodiment of the present invention.

[0029] Referring to FIG. 3, the device for controlling drying of laundry in a drum type washing machine includes a motor 110 for rotating a drum (see reference symbol 6 in FIG. 1), a motor sensing part 120 for detecting a rotation speeds of the motor 110, a fan 150 for blowing air into the drum, a drying heater 140 for heating air from the fan 150, and a controlling part 130 for automatic control of a laundry drying time period according to a rotation power of the motor 110.

[0030] The operation of, and a method for controlling drying of laundry in a drum type washing machine in accordance with a preferred embodiment of the present invention will be described, with reference to FIG. 4.

[0031] When a user introduces laundry into a drum, and selects a washing mode or a washing course the user desires, the controlling part 130 rotates the drum in regular/reverse direction to detect an amount of the laundry. In this instance, the controlling part 130 detects the amount of laundry with reference to a load on the motor 110 at the time of regular/reverse direction rotation of the drum. Then, the controlling part 130 determines a water level, a washing time period, a rinsing time period and a number of rinsing, a spinning time period according to the amount of laundry. The controlling part 130 also can set a drying time period according to the amount of laundry, automatically. Then, the controlling part supplies water to the drum until a determined water level is reached, together with detergent.

[0032] When water is filled up to a determined water level, the controlling part 130

puts the motor 130 into operation for carrying out the washing cycle according to the washing mode the user selects. (S11). A rotating power of the motor 110 is transmitted to the drum through a belt, to rotate the drum at a regular frequency. The laundry is washed owing to friction with the drum, and the impact of fall after lifted together with water and detergent inside of the drum.

[0033] Then, if the washing cycle is finished, used water is discharged to an outside of the washing machine, and the rinsing cycle is started after water is supplied to the drum again. (S12). The rinsing cycle is repeated for a determined number of times according to the washing mode selected by the user.

[0034] The spinning cycle is started if the rinsing cycle is finished. In the spinning cycle, rotation (or RPM) power and time period of the motor 110 may be set by the user, or by the controlling part 130 according to an amount or kinds of the laundry, automatically. While the spinning cycle is progressed, the motor sensing part 120 detects a rotation speed of the motor 110, and the controlling part 130 stores it. (S13).

[0035] Then, after finishing the spinning cycle, the controlling part 130 determines if the user selects the drying cycle. (S14). If it is determined that the user selects no drying cycle, the controlling part 130 finishes the operation of the washing machine. Opposite to this, if it is determined that the user selects the drying cycle, the controlling part 130 compares a maximum value of the stored rotation speed to a first set rotation speed. (S15).

[0036] The first set rotation speed, set in advance and stored in the controlling part 130, is for an example, 1400 RPM. If the motor 110 rotates 140 RPM, the controlling part 130, determining that extraction of water from the laundry is enough, sets an appropriate drying cycle. In other words, if the maximum value of the rotation speed is equal to or higher than the first set rotation speed, the controlling part 130 sets a drying cycle time period to a first

drying time period T1. (S16). Then, the controlling part 130 progresses the drying cycle for the first drying time period T1. (S23). In this instance, the controlling part 130 controls the fan 150 to blow air, and controls the drying heater 140, to heat the air.

[0037] If the maximum value of the rotation speed is lower than the first set rotation speed, the controlling part 130 compares the rotation speed with a second set rotation speed. (S17). The second set rotation speed is a value lower than the first set rotation speed, for an example, 1200 RPM. If the maximum value of the rotation speed is equal to, or higher than the second set rotation speed, the controlling part 130 sets the drying cycle time period to a second drying time period T2. (S18). The second drying time period T2 is longer than the first drying time period (T2). In other words, the controlling part 130, determining that the extraction of water from the laundry is not enough if the rotation speed of the motor 110 is lower than the first set rotation speed, sets the drying cycle time period longer than the first drying time period T1. Then, the controlling part 130 progresses the drying cycle for the second drying time period T2. (S23).

[0038] If the maximum value of the rotation speed is lower than the second set rotation speed, the controlling part 130 compares the rotation speed to a third set rotation speed. (S19). The third set rotation speed is lower than the first, or second set rotation speed, for an example, 1000 RPM. If the maximum rotation value is equal to, or higher than the third set rotation speed, the controlling part 130 sets the drying cycle time period to the third drying time period T3. (S20). The third drying time period T3 is longer than the first or second drying time period T1 or T2. Then, the controlling part 130 progresses the drying cycle for the third drying time period T3. (S23).

[0039] If the maximum value of the rotation speed is lower than the third set rotation speed, the controlling part 130 compares the rotation speed to a fourth set rotation speed.

(S21). The fourth set rotation speed is lower than the first, second, or third set rotation speed, for an example, 800 RPM. If the maximum rotation value is equal to, or higher than the fourth set rotation speed, the controlling part 130 sets the drying cycle time period to the fourth drying time period T4. (S20). The fourth drying time period T4 is longer than the first, second, or third drying time period T1, T2, or T3. If the rotation speed of the motor 110 is lower than the first, second, or third set rotation speed, the controlling part 130 set the drying cycle time period longer than the first, second, third time period T1, T2, or T3. Then, the controlling part 130 progresses the drying cycle for the third drying time period T4. (S23).

[0040] The first, second, third, and fourth set rotation speeds, and the first, second, third, and fourth drying time periods T1, T2, T3, and T4 are value stored in the controlling part 130. The set rotation speeds, and the drying time periods may be set in more than five levels. Moreover, the first, second, third, and fourth drying time periods T1, T2, T3, and T4 may be set not only according to the set rotation speeds, but also according to an amount of the laundry. In other words, after being set according to the amount of laundry detected before the washing cycle S11, the drying cycle time period may be adjusted according to the rotation speed of the motor 110 stored in the spinning cycle, automatically.

[0041] As has been described, the device and method for controlling drying of laundry in a drum type washing machine of the present invention has the following advantages.

[0042] Since the drying time period is adjusted according to a rotation speed of the washing motor in the spinning cycle, the drying cycle time period can be adjusted according to a level of water extraction from the laundry. According to this, waste of power caused by insufficient, or excessive drying of the laundry can be reduced.

[0043] It will be apparent to those skilled in the art that various modifications and

variations can be made in the present invention without departing from the spirit or scope of the invention. Thus, it is intended that the present invention cover the modifications and variations of this invention provided they come within the scope of the appended claims and their equivalents.